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(54) Lubricant.

(57) A lubricant comprising an oil-in-water emulsion having a viscosity of at least 68 mm²/sec. measured on a Brookfield Viscometer with a No. 1 spindle at 25 rpm and 25 °C and comprising:

(i) a continuous phase of a substantially oil-free, aqueous, emulsion-free composition comprising a major amount by weight of water, a minor amount by weight of a substantially water-insoluble oil-soluble EP agent stably dispersed therein, and a minor amount by weight of at least one substantially water-soluble liquid organic dispersing agent which is capable of dissolving the EP agent and of stably dispersing the EP agent in the aqueous composition; and

(ii) a discontinuous dispersed phase of an oil.

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Lubricant**BACKGROUND OF THE INVENTION**

This invention relates to lubricants.

There is available on the market a water-based lubricant which comprises a substantially oil-free, aqueous, emulsion-free composition of matter comprising a major amount of water including up to as much as 99.9 percent by weight of water, a minor but effective amount of at least one substantially water-insoluble, oil-soluble functional additive stably dispersed therein, and a minor but effective amount of at least one substantially water-soluble, liquid organic dispersing agent which is capable of dissolving the functional additive and of stably dispersing the functional additive in the composition.

The composition is formed by premixing the functional additive and the dispersing agent followed by adding this mixture to the water. The preferred functional additive is an extreme pressure (EP) agent such as a sulphur- or chlorosulphur- extreme pressure agent, a chlorinated hydrocarbon or phosphorus extreme pressure agent or a mixture of two or more of these agents. The composition can optionally contain at least one water-soluble polymeric thickener.

Lubricants of this type are described and claimed in British Patent No. 1,591,652.

Surf

the claim

SUMMARY OF THE INVENTION

According to the present invention, there is provided a lubricant comprising an oil-in-water emulsion having a viscosity of at least 68 mm²/sec. measured on a Brookfield Viscometer with a No. 1 spindle at 25 rpm and 25°C and comprising:

- (i) a continuous phase of a substantially oil-free, aqueous, emulsion free composition comprising a major amount by weight of water, a minor amount by weight of a substantially water-insoluble oil-soluble EP agent stably dispersed therein, and a minor amount by weight of at least one substantially water-soluble liquid organic dispersing agent which is capable of dissolving the EP agent and of stably dispersing the EP agent in the aqueous composition; and
- (ii) a discontinuous dispersed phase of an oil.

Further according to the invention, there is provided a method of producing such a lubricant including the steps of providing an aqueous composition as described above, thickening the composition with a thickener which is also capable of stabilising the emulsion and adding an oil to the thickened water-based composition under conditions suitable to produce an emulsion.

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DETAILED DESCRIPTION OF THE INVENTION

The lubricant of the invention is one which has a relatively high viscosity. This means that the lubricant has a viscosity of at least 68 mm²/sec. measured on a Brookfield viscometer with a No. 1 spindle at 25 rpm and 25°C or measured on a Canon Fenske tube at 40°C. The lubricant has a grease-like consistency and can be applied by spraying, brushing, trowelling or like manner to an area to be lubricated. The grease-like consistency of the composition enables it to stick, and be retained on a surface to which it is applied without readily running off. This is one characteristic which distinguishes the lubricant from the water-based lubricant of British Patent No. 1,571,652 which is liquid and free flowing. The lubricant of the invention can thus be used in applications where the water-based lubricant of this British patent cannot be used.

The emulsion is of the oil-in-water type, i.e. the aqueous composition forms the continuous phase while the oil forms the discontinuous phase dispersed in the continuous phase. Typically the aqueous composition constitutes 99 to 60% by weight of the emulsion and the oil constitutes from 1 to 40% by weight of the emulsion. Preferably, the aqueous composition constitutes 92 to 80% by weight of the emulsion and the oil constitutes 8 to 20% of the emulsion.

The oil is preferably a synthetic oil. Examples of suitable synthetic oils are di-esters, neopentyl polyol esters, phosphate esters, methyl silicones, phenyl methyl silicones, chlorinated phenyl methyl silicones, polyalkyl ne glycols, typically polypropylene glycols, chlorinated di-phenyls, silicate esters, polyphenyl ethers and fluorocarbons.

The oil preferably has dissolved therein an extreme pressure (EP) agent which is soluble in the oil and

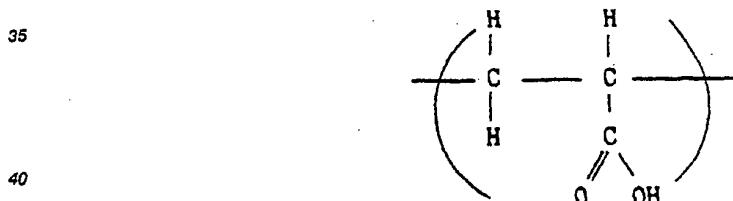
which is water-insoluble. The EP agent is preferably a sulphur or chlorosulphur EP agent, a chlorinated hydrocarbon EP agent, or a phosphorous EP agent. Examples of such EP agents are chlorinated wax, organic sulfides and polysulfides, such as benzyl disulfide, bis-(chlorobenzyl) disulfide, dibutyl tetrasulfide, sulfurized sperm oil, sulfurized methyl ester of oleic acid, sulfurized alkylphenol, sulfurized dipentene, 5 sulfurized terpene, and sulfurized Diels-Alder adducts; phosphosulfurized hydrocarbons, such as the reaction product of phosphorus sulfide with turpentine or methyl oleate, phosphorus esters such as the dihydrocarbon and trihydrocarbon phosphites, i.e. dibutyl phosphite, diheptyl phosphite, dicyclohexyl phosphite, pentylphenyl phosphite; diphenylphenyl phosphite, tridecyl phosphite, distearyl phosphite and polypropylene substituted phenol phosphite, metal thiocarbamates, such as zinc dioctyldithiocarbamate and 10 barium heptylphenol diacid, such as zinc dicyclohexyl phosphorodithioate, and the zinc salts of a phosphorodithioic acid. The EP agent is the oil is preferably present in an amount of 1 to 10% by weight of the oil.

To ensure that the emulsion is stable over long periods of suitable emulsifier or emulsion stabiliser 15 should be present. The emulsifier will be one capable of producing an oil-in-water emulsion from the oil used and the water. Examples of suitable emulsifiers are alkylaryl sulfonates, lignosulfonate salts, starch and the like. The emulsifier will be chosen to suit the characteristics of the oil used in the emulsion. The emulsifier will typically be present in an amount of 1 to 50%, preferably 2 to 10% by weight of the oil.

The emulsion may be made by methods known in the art. Typically, the aqueous composition will be 20 agitated, for example by vigorous stirring, with the oil in the presence of an emulsifier or emulsion stabiliser. The emulsifier may be dissolved in the aqueous composition or in the oil depending on its solubility characteristics.

The emulsion may be thickened to the required viscosity by adding a suitable thickener. This thickener 25 will typically be added to the aqueous composition before the emulsion is produced, but it can also be added after the emulsion has been produced. Examples of suitable thickeners are described in British Patent No. 1,571,652. More than one thickener may be used.

A preferred method of producing the emulsion, which method forms another aspect of the invention, comprises providing the water-based composition, thickening the composition by adding thereof a thickener which is also capable of stabilising an emulsion, and adding the oil to the thickened aqueous composition under conditions, e.g. vigorous agitation, suitable to produce an emulsion. The thickener is preferably added 30 in an amount of up to 3% by weight of the aqueous composition. The thickener which also functions as an emulsion stabiliser is preferably a water-soluble acrylic acid polymer which has recurring units of the general structure:



Such polymers are sold under the name Carbopol® by the B.F. Goodridge Company. The preferred 45 polymers are Carbopol 910 and Carbopol 941.

The aqueous composition will be of the type and having the characteristics of those described in British patent No. 1,591,652, the contents of which are incorporated herein by reference.

The lubricant of the invention may also include minor amounts by weight of other materials such as 50 solid lubricants, corrosion inhibitors, friction modifiers, film formers and the like. When the composition includes a solid lubricant it may, for example, be selected from a graphite, molybdenum disulfide, and powdered PTFE (polytetrafluoroethylene).

The lubricant of the invention contains an aqueous composition and an oil, each of which is a lubricant. It has surprisingly been found that, particularly when the oil is a synthetic oil, the lubricant of the invention 55 has lubricating properties which are better than the lubricating properties of either of the individual components. It is believed that a synergistic action operates. Further, the compositions are water-resistant in the sense that they are not adversely affected by the presence of water. This distinguishes them from known and commonly used oils and greases which are adversely affected by the presence of water. The water-resistant properties of the lubricant of the invention renders it ideally suitable for applications such as in bearings where water is present. The higher viscosity and grease-like consistency of the composition

enables it to be used in applications such as open gear dressings, chain saw lubrication, and in bearings. Other applications for the lubricant are in rock drilling, diamond prospecting drilling, oil well drilling, and tapping.

This invention will be illustrated by the following examples.

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EXAMPLE 1

An aqueous composition of the type described in British Patent 1,571,652 was prepared by assembling 10 the following ingredients in the indicated amount:

	Ingredient	Amount
(a)	Hydroxy ethyl cellulose (Natrosol LR)	40 g
(b)	Zinc dithiophosphate	2 g
(c)	A first portion of polypropylene glycol (Pluriol P900)	1 g
(d)	Anglamol 32	1 g
(e)	A second portion of polypropylene glycol (Pluriol P900)	2 g
(f)	Diethanolamine	5 g
(g)	Emulan SH	10 g
(h)	Ethylene glycol	50 g
(i)	Dye	1 g

25 Ingredient (a) was dispersed in 600ml of water and allowed to hydrate. Ingredients (a) and (c) were mixed and dispersed well into a portion of the thickened water. Ingredients (d) and (e) were mixed and dispersed well into the remainder of the thickened water. The two portions of the thickened water were recombined and agitated to form a homogeneous dispersion. The remaining ingredients were added individually to the thickened mixture which was agitated after each addition.

30 The thus produced water-based composition was thickened by adding to it 8 gms of Carbopol 910. The composition was neutralised by the addition of diethanolamine. 2g of molybdenum dithiophosphate and 10g of zinc dithiophosphate were added to 80g of a polypropylene glycol sold under the trade name Pluriol P2000. The pre-mix was then added to the thickened water-based composition with agitation to produce a stable emulsion. The emulsion has a viscosity of exceeding 12000 mm²/sec. measured on a Brookfield viscometer with a No. 1 spindle at 25 rpm and 25°C.

35 The lubricant described above was subjected to a standard Reichert test and compared with a commercially available extreme pressure mineral oil and with the water-based composition of British Patent No. 1591652, described above. In the Reichert test a ring is rotated against a loaded pin in the presence of the lubricant. The lower the abrasion area measured, the better the lubricant. The results obtained are set out in Table 1.

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TABLE 1

Lubricant	Abrasions Area (mm ²)
Extreme Pressure Mineral Oil	24,6
Water based Composition of 1591652	12,3
Lubricant of the Invention	5,1

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EXAMPLE 2

55 A lubricant was produced in the manner described in Example 1 save the the molybdenum dithiophosphate and zinc dithiophosphate were not added to the polypropylene glycol. The polypropylene glycol was used on its own without any such addition of an EP agent.

The lubricant thus produced was subjected to the same Reichert test and compared with a commer-

cially available sulphur/phosphorus grease and with the water-based composition of British Patent No. 1,591,652, described in Example 1. The results obtained are set out in Table 2

TABLE 2

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Lubricant	Abrasion Area (mm ²)
Grease	32
Water based composition of 1591652	12
Lubricant of the invention	10

It will be noted from the above Tables 1 and 2 that the abrasion area measured for the lubricant of the invention was substantially lower than that of the composition of British Patent No. 1,591,652, the extreme pressure mineral oil and the grease. Indeed, the results were of such an improved nature that it is believed there is synergistic action between the polypropylene glycol and the water-based composition of the British patent.

20 Claims

1. A lubricant comprising an oil-in-water emulsion having a viscosity of at least 68 mm²/sec. measured on a Brookfield Viscometer with a No. 1 spindle at 25 rpm and 25 °C and comprising:
 - (i) a continuous phase of a substantially oil-free, aqueous, emulsion free composition comprising a major amount by weight of water, a minor amount by weight of a substantially water-insoluble oil-soluble EP agent stably dispersed therein, and a minor amount by weight of at least one substantially water-soluble liquid organic dispersing agent which is capable of dissolving the EP agent and of stably dispersing the EP agent in the aqueous composition; and
 - (ii) a discontinuous dispersed phase of an oil.
2. A lubricant according to claim 1 wherein the oil is a synthetic oil.
3. A lubricant according to claim 2 wherein the synthetic oil is selected from di-esters, neopentyl polyol esters, phosphate esters, methyl silicones, phenyl methyl silicones, chlorinated phenyl methyl silicones, polyalkylene glycols, chlorinated di-phenyls, silicate esters, polyphenyl ethers and fluorocarbons.
4. A lubricant according to any one of the preceding claims wherein the aqueous composition constitutes 99 to 60% by weight of the emulsion and the oil constitutes 1 to 40% by weight of the emulsion.
5. A lubricant according to any one of claims 1 to 3 wherein the aqueous composition constitutes 92 to 80% by weight of the emulsion and the oil constitutes 8 to 20% by weight of the emulsion.
6. A lubricant according to any one of the preceding claims wherein the oil has dissolved therein an oil-soluble and water-insoluble EP agent.
7. A lubricant according to claim 6 wherein the EP agent is selected from sulphur, chlorosulphur, chlorinated aliphatic hydrocarbon and phosphorus EP agents.
8. A lubricant according to claim 6 or claim 7 wherein the EP agent is present in the oil in an amount of 1 to 10% by weight of the oil.
9. A method of producing a lubricant according to any one of the preceding claims including the steps of providing a substantially oil-free, aqueous, emulsion free composition comprising a major amount by weight of water, a minor amount by weight of a substantially water-insoluble oil-soluble EP agent stably dispersed therein, and a minor amount by weight of at least one substantially water-soluble liquid organic dispersing agent which is capable of dissolving the EP agent and of stably dispersing the EP agent in the aqueous composition, thickening the aqueous composition with a thickener which also is capable of stabilising an oil-in-water emulsion and adding an oil to the thickened composition under conditions suitable to produce the emulsion.
10. A method according to claim 9 wherein the thickener is a water-soluble acrylic acid polymer.
11. A method according to claim 9 or claim 10 wherein the thickener is added in an amount of up to 3% by weight of the aqueous composition.



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EUROPEAN SEARCH REPORT

Application Number

EP 88 10 7051

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.4)
D, X	GB-A-1 591 652 (SINGER & HERSCHE) * Whole document *	1,9-11	C 10 M 173/02 C 09 K 7/02
Y	---	2-8	
Y	EP-A-0 024 848 (MOBIL OIL) * Claim 1; page 7, paragraph 3; page 8, paragraph 3 *	2-8	
A	DE-A-2 926 513 (DYNAMIT NOBEL) * Claims 1-4; page 8 - page 9, line 29 *	2-8	
A	US-A-4 313 836 (A. NASSRY) * Claims 1-12 *	1,9-11	
A	EP-A-0 102 212 (CASTROL LTD) * Claims 1-19 *	1-11	
			TECHNICAL FIELDS SEARCHED (Int. CL.4)
			C 10 M C 09 K
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	30-11-1988	ROTS AERT L.D.C.	
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	